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Phytogeographical notes on the Rocky Mountain region
IV. Forests of the Subalpine and Montane Zones*

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The mountain regions may be divided into four zones: (1) the ALPINE ZONE, above the timberline; (2) the SUBALPINE ZONE; (3) the MONTANE ZONE; (4) the FOOTHILL ZONE. These correspond to Dr. Merriam's ARCTIC, HUDSONIAN, CANADIAN, and TRANSITION life-zones, respectively. The Alpine Zone has already been discussed by me in three preceding papers. The Subalpine and Montane Zones are more or less mesophytic, while the Foothills are decidedly xerophytic. The characteristic trees of the last are the bull pines and nut-pines and the cedars, which there seldom form dense woods, but grow more or less scattered on the hillsides. The Subalpine and Montane Zones are characterized (with the exception of the exposed ridges and larger open valleys or "parks") by more or less dense woods of spruce, fir, pines and aspen. Many do not distinguish these two zones, and no definite line can be drawn between them. Most of the plants are common to both; the most characteristic tree of the Subalpine Zone, the Engelmann spruce, extends far down into the Montane Zone, and several of the principal components of the latter, especially the Douglas spruce, extend far up into the former. In general the division line may be placed at the upper limit of growth of the bull-pine and the lower of the subalpine fir. This varies considerably. In Colorado it may be placed at an altitude of 3,000 m. (10,000 ft.), in the Yellowstone National Park at 2,300–2,500 m. (7,500–8,000 ft.), in the Glazier Park Region of Montana at about 2,000 m. (6,500 ft.), and in the Selkirk Mountains of British Columbia still lower.

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* This article is not intended to present any new facts, but merely a summary. The only feature as far as I know that has never been presented in print in this form is the division line drawn between the Northern and Southern Rockies and the reasons for drawing it at that particular place. The distribution of the forest trees both altitudinally and geographically has been treated more extensively and in greater detail elsewhere, both in the various "tree books" and in the reports from the United States Forest Reserves, but a short resumé is always desirable.

A region which extends twenty degrees in latitude* will naturally not be homogeneous, as far as its vegetation is concerned. It also can be divided into two principal parts: the Northern and the Southern Rockies. In Wyoming, about where the Union Pacific Railroad is drawn across, there is a break in the high mountain chain. This break may be regarded as the division line between the Northern and the Southern Rockies.

The larger part of the Southern Rockies is within the state of Colorado, but they extend south into New Mexico to Santa Fe, and northward into Wyoming, where they are known as the Medicine Bow Mountains. West of the Southern Rockies and separated from them by the Green River basin are the Uintah and Wasatch Mountains. The former have practically the same flora as the Southern Rockies, but the western slope and southern end of the Wasatch Range partake of the floral nature of the isolated mountain chains of the Great Basin. The northern end of the Wasatch Mountains, the range enclosed by the horseshoe bend of the Bear River in southern Idaho, is the most northerly extension of the floral district of the Southern Rockies. It is here and across the Bear River in the Teton Mountains, not along the continental divide in Wyoming, that the floras of the Northern and Southern Rockies meet.

The Northern Rockies form an uninterrupted chain from Yukon Territory to the Wind River Mountains in Wyoming and the flora is practically homogeneous, except the western slope of the northern portion. To the Northern Rockies should also be counted several more or less isolated mountain ranges, as the Saw-tooth Mountains of central Idaho, the Tetons of western Wyoming, the Cypress Hills in Saskatchewan, several ranges in Montana, the Bighorn Mountains in northern Wyoming and the Black Hills and several smaller chains in their neighborhood. None of these except the Big Horns and the Tetons can be taken in account when the subalpine flora is considered. The Selkirk Mountains between the bends of the Upper Columbia River, much closer to the Rockies, and separated from the Cascades by the Columbia and Frazer River valleys, have a flora resembling that of the Cascades as much as that of the Rockies. This Cascade flora, however, extends also to the western slopes of the Rockies in British Columbia and northern Montana as well as into the Bitter Root Mountains between that state and Idaho, although the Bitter Roots are separated from the Selkirks by the valleys of Kootenay River and Clark's Fork.

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* My discussion in this paper refers only to the region between 35° and 55° latitude.

This division between Northern and Southern Rockies is not made merely on geographical grounds, i. e., because there is a break in the high mountain chain where the plains actually cross over the continental divide. The flora shows also many differences; this is especially the case with the more characteristic species, the trees. It is true that a number of these are common to the Northern and Southern Rockies, as, for instance, *Picea Engelmannii*, *Pinus scopulorum*, *Pinus Murrayana*, *Pinus flexilis*, *Pseudotsuga mucronata*, *Abies lasiocarpa*, *Sabina scopulorum*, *Betula fontinalis*, *Alnus tenuifolia*, and several species of *Crataegus*, *Salix*, and *Populus;* but others are not.

Pinus aristata, *P. edulis*, *Picea Parryana*, *Abies concolor*, *Sabina utahensis*, *S. monosperma*, *Populus Wislizeni*, *P. Fremontii*, *Fraxinus anomala*, and the oaks of the *Quercus Gambellii* and *Q. undulata* groups are characteristic of the Southern Rockies. Of these only *Picea Parryana* has been collected in what belongs to the Northern Rockies. The only authentic locality there that I know is in the Teton Mountains, and these are, as stated before, in the region where the two floras meet. *Abies concolor* extends into the Bear River Mountains but does not cross the line, although it is found much farther north in western Oregon. It has been reported from other parts of Idaho, but evidently has been confused with *A. grandis*, at least all specimens I have seen named *A. concolor* belong to that species. *Sabina utahensis* is found on the southwestern slopes of Wind River Mountains in the Green River basin, but this species belongs to the foothills and not to the mountains proper. The only oak found in the Northern Rocky Mountain region is *Quercus macrocarpa*, and this only in the Black Hills. It is not found in the Southern Rockies and it is an invader from the prairie region. The same can be said about *Ulmus americana* and *Ostrya virginiana*. There are still more trees of the Northern Rockies which are not found in the southern part, such as *Larix occidentalis*, *L. Lyallii*, *Abies grandis*, *Tsuga heterophylla*, *T. Mertensiana*, *Picea albertiana*, *Pinus monticola*, *P. albicaulis*, *Thuja plicata*, *Taxus brevifolia*, several species of *Betula* and *Salix*, *Populus trichocarpa*, *P. hastata*, and *P. Besseyana*. It is true that most of the conifers mentioned belong principally to the Selkirk-Bitter Root region, but this is not the case with *Picea albertiana* and *Pinus albicaulis*, which extend as far south as the Yellowstone Park. *Abies grandis* has also been reported from there, and *Pinus monticola* a little north thereof.

SUBALPINE ZONE OF THE SOUTHERN ROCKIES

The characteristic trees of the Subalpine Zone of the Southern Rockies are *Picea Engelmannii* and *Populus tremuloides*, with *Pinus aristata* and *Abies lasiocarpa* as secondary ones.

The ENGELMANN SPRUCE, or, as it is usually called in the Rockies, the white spruce, has its best development in Colorado at an altitude between 10,000 and 11,500 feet. It extends up to the timberline, 11,500–11,800 feet or rarely up to 12,000 feet. This region from about 10,000 feet to the timberline may therefore be regarded as the Subalpine Zone. The spruce grows often in pure stands, as in the La Sal Mountains, or mixed with the subalpine fir, *Abies lasiocarpa*, and the forests usually cover the northern slopes, except where the conditions are such that no trees can grow. In favorable localities it also grows on the southern slopes, there occasionally mixed with *Pinus aristata*. It is not confined, however, to the Subalpine Zone, but extends far down on the northern slopes into the Montane Zone as low as to 7,000 or 6,500 feet altitude. Here, as well as in the lower portion of the Subalpine Zone, it is often mixed with the Douglas or red fir, *Pseudotsuga mucronata*, the blue spruce, *Picea Parryana*, the balsam fir, *Abies concolor*, the limber pine, *Pinus flexilis*, and the lodge-pole pine, *Pinus Murrayana*. *Picea Engelmannii* extends throughout the northern Rocky Mountain region, but is not there so exclusively the tree characteristic of the Subalpine Zone.

The Engelmann spruce is a slender tree with narrow crown, therefore offering little resistance to the wind. The branches are short, slender and deflexed, therefore well adapted for shedding the falling snow. It is, hence, very well adapted to the severe climate of the mountain peaks. At the timberline it, as well as *Abies lasiocarpa*, becomes stunted, low, with the lower branches enormously elongated and closely pressed to the ground. The Engelmann spruce is a slow grower, naturally so on account of the poor and rocky soil and the severe climate. On a stump from a tree cut in the La Sal Mountains, measuring 26 inches, I counted over 260 annual rings. In very favorable conditions it may reach a height of 120 feet and a diameter of about 3 feet.

Next to the Engelmann spruce, the ASPEN is the most common tree in the Subalpine region of Colorado. It grows on both slopes, usually in groves, but sometimes mixed, and usually prefers rich soil. After the spruce wood has been destroyed by forest fires, it often takes possession of the ground, as its seeds germinate more quickly and it is a faster grower. It reaches its best development along streams and in springy places. It is seldom found up to an altitude of more than 11,000 feet and its height is seldom over 25 or 30 feet in this region.

The FOX-TAIL PINE, range pine, or prickle-cone pine, *Pinus aristata*, is the chief tree of the southern slopes of the Southern Rockies. It is not found in the Northern Rockies at all, but exists in the mountains of the Great Basin and in the southern Sierra Nevada. It is a bulky tree, branched usually near the base. In favorable situations it sometimes reaches a height of 50 feet, with a trunk 3 feet in diameter. Near the timberline it becomes very gnarled, crooked, and twisted, with the branches short and few on the windward side and unproportionally developed on the leeward one. It never forms the depressed cushion-like or sugar-loaf-like growth of *Picea Engelmannii* or *Abies lasiocarpa* in similar situations. *Pinus aristata* is a characteristic tree of the Sulbapine Zone, only rarely found in the Montane Zone as low as 8,000 feet. If found there it grows mostly with *Pinus flexilis*, as it does sometimes in the Subalpine Zone.

The fourth of the trees of the Subalpine Zone is the SUBALPINE FIR, *Abies lasiocarpa*. It usually grows scattered among *Picea*

Engelmannii or at lower altitudes sometimes with *Pinus Murrayana*. It is usually a small tree, very rarely reaching 70 or 80 feet in height, with a trunk of 2 feet in diameter, the average good-sized tree being 45 or 50 feet high. It is found at an altitude of from about 9,000 feet to the timberline.

The limber pine, *Pinus flexilis*, belongs really to the Montane Zone, where it has its best development, but extends into the Subalpine Zone almost to the timberline.

SUBALPINE ZONE OF THE NORTHERN ROCKIES

As the Northern Rockies are of much larger extent than the Southern and the conditions are much more variable, the description of the different zones of one locality will poorly fit for all places. I shall therefore first select a fairly typical region near the center of the district and then contrast with this the outlying regions. The region selected is the main range of the Rockies in northern Montana. The Subalpine Zone in this region extends from an altitude of about 6,500 feet to the timberline. The most important tree is, as in the Southern Rockies, the Engelmann spruce (*Picea Engelmannii*), but it becomes less predominant, and the subalpine fir, *Abies lasiocarpa*, becomes more frequent. Both are characteristic of the northern exposures.

The ENGELMANN SPRUCE, just as in the Southern Rockies, is not limited to the Alpine Zone, but runs down through the Montane Zone to a little below 5,000 feet, and is there confined mostly to the northern slopes and valleys. In this region it sometimes reaches a height of 125 feet, with a trunk 3 feet in diameter. In some places especially on the west side of the Bitter Root Mountains, it is more or less supplanted by the next.

The SUBALPINE FIR, *Abies lasiocarpa*, grows between an altitude of 6,000 feet and timberline, rarely lower down. Under favorable conditions it reaches a height of 75 feet, with a trunk diameter of 2 feet.

The WHITE-BARKED PINE, or, as it is called in Montana, the nut pine, *Pinus albicaulis*, takes the place of *P. aristata* on the southern exposures, often growing scattered in grassy "parks." It resembles the same somewhat in growth, although it is more closely related to *P. flexilis*. It is a tree 20 to 40 feet high, with a trunk

1 to 4 feet thick. At the timberline it becomes low, crooked, and gnarled.

The LYALL'S LARCH, *Larix Lyallii*, is the most hardy tree of the region. In moist valleys it reaches higher up than either the spruce or the fir, and is more strictly a subalpine species than either, growing mostly above 7,500 feet altitude. In the main Rockies, it is not found south of latitude 48° 45′, but runs further south in the Bitter Root Mountains. It is mainly confined to the western slope of the Rockies, and crosses the main divide only north of Culver Glazier, latitude 48° 50′. It is a tree of slow growth, becoming 25 to 40 feet high and having a diameter of 2 to 4 feet.

The ASPEN plays here the same rôle as in the Southern Rockies, but is perhaps not so common.

In the lower portion of the Subalpine Zone, the lodge-pole pine, limber pine and Douglas fir are found on the drier slopes. In some places the former tree is the most common of all. The limber pine is rare on the west side of the divide.

In the Bitter Root Mountains the dividing line between the Subalpine and Montane Zones is slightly lower. The principal trees here are the same as in the main Rockies. The general distribution of the subalpine fir is above 4,800 feet in the northern part and 5,500 feet in the southern part, although it sometimes descends as low as 3,000 feet. Here it is much more common than *Picea Engelmannii* and is the characteristic tree of the Subalpine Zone. The latter grows mostly at 4,000 to 7,000 feet altitude. Lyall's larch is found along the main range of the Bitter Root Mountains to the headwaters of the south fork of the Clearwater River, latitude 45° 50′. *Pinus albicaulis* grows mostly above 6,000 feet altitude. *Pinus Murrayana* ascends to 8,000 feet and *Pseudotsuga mucronata* to 6,500 or 7,000 feet. *Pinus flexilis* is wanting. The first of these three species, i. e., *P. Murrayana*, is the most common tree on the eastern slopes of the Bitter Root Mountains and there makes up about ninety per cent. of the forest.

To the other subalpine trees are here added the ALPINE HEMLOCK, *Hesperopeuce Mertensiana*. It grows at an altitude of from 5,500 to 8,000 or even 9,000 feet. It is a tree of 60 to 100 feet in height and 3 to 6 feet in diameter with a greatly developed crown. It is not found in the main Rockies, at least not within the United States. It is not uncommon in the Selkirks and extends south in the Bitter Roots as far as to the divide between the north and middle forks of Clearwater River.

In the Yellowstone Park and in the Tetons, the Subalpine Zone begins at an altitude of 7,500 or 8,000 feet and the timberline is at an altitude of about 10,000 feet. The trees are the same as those of northern Montana, except that the Lyall larch is lacking and the lodge pole pine is more common near the lower border.

In the Big Horn Mountains both the Engelmann spruce and the subalpine fir are scarce and in most cases the upper limit of the lodge pole pine constitutes the timberline.

In the Black Hills a Subalpine Zone can scarcely be spoken of, as the highest mountains are less than 7,500 feet. The subalpine species of the Rockies are wholly lacking.

MONTANE ZONE OF THE SOUTHERN ROCKIES

The upper and lower limits of the Montane Zone in Colorado are approximately at an altitude of 10,000 and 7,500 to 8,000 feet. The former is about the upper limit of *Pinus scopulorum*, the latter near the lower limit of *Pinus Murrayana*, and *Pseudotsuga mucronata* is rare below this altitude in Colorado. These three trees together with *Picea Engelmannii* are the most important timber trees of this zone.

The southern slopes of the mountains and the tops of the table lands are more or less xerophytic, and here the bull pine or yellow pine, *Pinus scopulorum*, and the Douglas or red fir, *Pseudotsuga mucronata*, are predominant. The northern slopes and more protected valleys and flats are decidedly mesophytic. The predominant tree on the northern slopes and in the valleys is the Engelmann spruce. The lodge-pole pine, *Pinus Murrayana*, is often found with the Engelmann spruce, but is often found on the upper plateaus in pure stands or mixed with the more xerophytic species.

The composition of the more *xerophytic forest* of the southern slopes is as follows:

The most important tree is perhaps the BULL PINE, *P. scopulo-*

rum, or, as it perhaps is more often known, *P. ponderosa scopulorum*. It is seldom found in Colorado above an altitude of 10,000 feet, which the writer regards as approximately the upper limit of the Montane Zone. It descends, however, far below the lower limit of this zone, even below an altitude of 5,000 feet; it is really in fact the only important tree of the foothills. It is a tree of wide distribution found nearly everywhere in the Montane and Foothill Zones of the whole Rocky Mountain region, as treated in this article. The only mountains I know of where it is lacking are the La Sal Mountains in eastern Utah, where the Douglas fir is also missing. The bull pine is a massive tree, sometimes becoming 110 to 125 feet in height and with a trunk almost 4 feet in diameter. A tree 3 feet in diameter is about 250 years old.

The DOUGLAS FIR, red fir, or red spruce, *Pseudotsuga mucronata*, is almost as important as the bull pine. It usually grows with the latter and reaches about the same size. It is common at an altitude of between 7,000 and 10,000 feet, but ascends sometimes as high up as 10,500 and very rarely up to nearly 11,000 feet, and descends seldom in the ravines as low as 6,000 feet. In the higher altitudes it mixes with *Pinus flexilis* and *P. aristata*, rarely with *Picea Engelmannii*, in the lower extremes it grows with the latter and *Abies concolor*. As to its geographical distribution, the Douglas fir has about as wide a distribution as any Rocky Mountain coniferous tree, the other widely distributed ones being *Picea Engelmannii* and *Pinus Murrayana*, and is surpassed among the trees only by the aspen. It ranges from Alberta and British Columbia to western Texas, northern Mexico and southern California.

The LODGE-POLE PINE comes next in importance. This is the most common conifer in the Montane Zone of the Northern Rockies, but is not so common nor so important in the Southern. It often grows in pure stands on gentle slopes or flats, but mixes also with other pines as well as with the Engelmann spruce. As the lodge-pole pine germinates more readily than the other conifers, it often takes possession of burnt-over areas, just as the aspen does. The young trees usually spring up close together and form almost impenetrable thickets. Standing so close together the trees grow very slowly in size and large trees are rare.

In open places they rarely reach a height of 50 feet and a trunk diameter of 2 feet or a little more. In Colorado the species grows at an altitude of 8,000 to 10,500 feet, sometimes descending below 8,000 feet and rarely reaching an altitude of 11,000 feet. Its range extends farther north than that of the *Pseudotsuga*, viz., up to Alaska, but not so far south.

The LIMBER PINE or white pine of Colorado, *Pinus flexilis*, is rather local, never plentiful, and as a rule mixed with other trees, mostly with *Pinus scopulorum* and *Pseudotsuga mucronata* at lower altitudes and with *Pinus aristata* at higher ones. It ranges from an altitude of 7,500 feet nearly up to timberline. It is therefore a tree common to the Subalpine and the Montane Zones. In general appearance it is intermediate between the foxtail pine and the bull pine and is often mistaken for either. It ranges from Alberta to western Texas and southern California.

The red cedar, *Sabina scopulorum*, belongs rather to the Foothill Zone, but ascends often to an altitude of 9,000 feet and grows associated with the bull pine.

The composition of the *mesophytic forest* of the northern slopes consists of the following trees:

The principal tree here, as in the Subalpine Zone, is the ENGELMANN SPRUCE, which has been discussed already.

The subalpine fir is found mostly in the transition region between 9,500 and 10,000 feet, rarely as low as 9,000 feet altitude.

The BALSAM FIR or Colorado white fir, *Abies concolor*, takes its place at lower altitudes, viz., between 8,000 and 9,000 feet. It is a tall symmetrical tree with short horizontal branches, sometimes reaching a height of 250 feet. Its geographical distribution extends over the Southern Rockies, Sierra Nevada and other mountains of California, north to the Siskiyou Mountains of Oregon, but it is not found in the Northern Rockies.

The Douglas fir and the lodge-pole pine are also mixed occasionally with the Engelmann spruce.

Along the water-courses the composition of the forest is as follows:

The COLORADO BLUE SPRUCE, *Picea Parryana*, is growing along the water courses in the region mostly occupied by the bull pine and Douglas fir. It is therefore often found on the southern slopes. It needs a good deal of moisture, but at the same time prefers an open forest, and stands less shade than the Engelmann spruce. This explains perhaps why it succeeds better as a planted tree in the Eastern States than any other western species. It ranges in altitudes from 6,500–9,000 feet or sometimes 10,000 feet, but descends into the foothills only in the valleys. It grows to the height of 90 feet and a trunk diameter of 2½ feet, or becomes rarely 100 feet high and 4 feet thick. It is limited to the Southern Rockies, and has been collected, as far as I know, only at one locality in what I regard as belonging to the Northern Rockies, viz., the Teton Mountains of western Wyoming.

The NARROW-LEAVED COTTONWOOD, *Populus angustifolia*, grows along the streams throughout the foothills as well as the Montane Zone, in other words at an altitude between 5,000 to 10,000 feet, or rarely as high as 10,500 feet. It becomes sometimes 50 feet high with a trunk nearly 2 feet in diameter, but this size is extremely rare. Individuals with somewhat broader leaves are sometimes mistaken for the balsam poplar, *P. balsamifera*. *Populus angustifolia* is distributed from North Dakota and Washington to New Mexico and California. The BALSAM POPLAR, *Populus balsamifera*, is rare in Colorado and belongs to the northern Rockies. It has about the same altitudinal distribution as the preceding and attains the same size or a little larger.

The WESTERN BLACK BIRCH, *Betula fontinalis*, and the ROCKY MOUNTAIN ALDER, *Alnus tenuifolia*, grow in similar situations, but never become trees of any large size. They are found throughout the Rocky Mountain region, in Colorado growing at an altitude between 5,500 and 9,000 feet, the latter sometimes reaching 10,000 feet.

Several species of willows are also found but most of these are mere shrubs.

The hawthorns (several species of *Crataegus*) and chokecherry, *Prunus melanocarpa*, enter the lower valleys but belong really to the foothills or Great Plains.

MONTANE ZONE OF THE NORTHERN ROCKIES

The Montane Zone of the Rockies in northern Montana contains more species than in Colorado, especially on the western side of the continental divide. On the eastern side the species are somewhat the same, but the proportion is different.

Eastern slope

The most common tree is the lodge-pole pine, growing on the dryer ridges from 5,000 to 8,000 feet altitude. It grows often in pure stands or mixed with Douglas fir and limber pine.

The Rocky Mountain bull pine, *Pinus scopulorum*, if found at all, is limited to the foothills or the mountain sides bordering thereon.

In the valleys with northeastern or northern exposure, the Engelmann spruce often is mixed with red fir and the ALBERTA SPRUCE, *Picea albertiana*. The latter is not generally distinguished from *Picea Engelmannii* or else mistaken for the eastern white spruce, *Picea canadensis*, which is not found in Montana, and further south for the blue spruce, *P. Parryana*. It much resembles the Engelmann spruce, but the twigs are glabrous and the cone-scales more rounded. The Engelmann spruce runs down as low as 6,000 feet altitude.

The deciduous trees are found mostly along the water courses. The most important are *Populus balsamifera* and *P. angustifolia*, *Betula papyrifera* and *Betula fontinalis*, *Alnus tenuifolia* and a few willows.

Western slope

The southern exposure is, as in the Southern Rockies, more xerophytic and this is mostly occupied by the lodge pole pine and the Douglas fir, ranging at an altitude between 3,000 or 4,000 to 7,000 or 8,000 feet. Below 4,000 feet the forest consists mostly of the WESTERN YELLOW PINE, *Pinus ponderosa*. This is closely related to *P. scopulorum* but has longer leaves and cones. Many regard the latter as a variety of the former. *P. ponderosa* is practically limited to the Pacific slope and has been reported from very few localities east of the divide. Contrary to its southeastern relative, it is found on rich soil. It belongs to the Arid Transition Zone of Washington and enters the Montane Zone only at its upper limit. It is a tree often over 200 feet high and with a trunk 5–8 feet in diameter.

On the northern exposures and in the canyons, the Engelmann spruce and the Subalpine fir in the upper part are common; but at an altitude of 5,000 or 6,000 feet, are met with the western tamarack or larch, silver fir, western hemlock, white cedar and western white pine.

The WESTERN TAMARACK, or LARCH, *Larix occidentalis*, grows at an altitude of from 3,000 to 6,000 feet or rarely 7,000 feet, and always close to the water courses. It is a tree 60–150 feet high and 2–4 feet in diameter. Further west it sometimes attains a height of 250 feet and 6–8 feet in diameter. It ranges from British Columbia to western Montana and Oregon, east of the Cascades. No station east of the divide has been recorded, as far as the writer knows.

The SILVER FIR, *Abies grandis*, grows up to an altitude of 6,000 feet, rarely 7,000 feet. Near the Pacific coast it attains a height of 250–300 feet and a diameter of 4 feet, but in the mountains it seldom becomes more than 100 feet high and 2 feet thick. Its distribution is from Vancouver Island to western Montana, Idaho and northern California. It hardly crosses the Continental Divide in northern Montana, but has been reported from the Yellowstone National Park.

The WESTERN HEMLOCK, *Tsuga heterophylla*, grows up to an altitude of 6,000 feet. On the coast it becomes a tree 200 feet high. It is distributed from British Columbia and western Montana to central California. It, as well as the next, barely crosses the Continental Divide north of St. Mary's Lake.

The WHITE CEDAR, or western arbor-vitae, *Thuya plicata*, grows also up to about 6,000 feet. It is a tree sometimes 200 feet high and with buttresses 15 feet in diameter, but in Montana it is much smaller. Its distribution extends from Alaska to western Montana and northern California.

The MOUNTAIN WHITE PINE, *Pinus monticola*, extends to about the same altitude in Montana, but much higher in California. It is generally a tree 100 feet high and 4–5 feet in diameter, rarely larger. It grows mostly on bottom-lands and along streams. Its distribution is from British Columbia and northwestern Montana to Kern County, California. It is not found east of the divide in northern Montana, but has been reported in southern Montana from the valleys of Davis and Slough Creeks north of the Yellowstone National Park.

The deciduous trees belonging to this zone grow all along the water courses. They are: the cottonwoods, *Populus trichocarpa*, the tallest deciduous trees of America, *P. hastata*, *P. Besseyana*, *P. balsamifera*, *P. angustifolia* (rare on the west side), and *P. tremuloides* (the three first are seldom found east of the divide); further, such willows as *Salix Lyallii*, *S. sessilifolia*, *S. Mackenzieana*, *S. Scouleriana*, and several others, scarcely becoming trees; the birches, *Betula papyrifera*, *B. fontinalis*, *B. Piperi*, *B. subcordata*, and *B. occidentalis;* alders, *Alnus tenuifolia;* several species of *Crataegus* and *Amelanchier*, etc.

The Montane Zone in the Canadian Rockies is practically the same, but both its upper and lower limits are found gradually lower and lower down the mountains the further north one goes.

In the Bitter Root Mountains, it resembles much that of the western slope of the Rockies. To the conifers are added the PACIFIC YEW, *Taxus brevifolia*, which often becomes only an insignificant shrub. The extent of the Zone is between 4,000 and 5,800 feet altitude and the most important trees here on the northern exposures are the mountain white pine, *Pinus monticola*, which, however, extends in the valleys as far down as 2,000 feet altitude, and *Larix occidentalis*. On the southern exposures, *P. ponderosa* and *Pseudotsuga mucronata* are predominant.

In the Yellowstone National Park and mountains north thereof, about half of the coniferous flora consists of the lodge-pole pine. Otherwise the conditions are the same as on the eastern slope in northern Montana, that is with a small amount of *Picea Engelmannii* and *P. albertiana* on the northern exposures; *Pinus flexilis* and *P. ponderosa* on the southern exposures, but the latter two only near the lower limit; some *Pseudotsuga* on both, and aspen and cottonwood along the water courses. On the level plateaus of the Yellowstone National Park the forest consists of pure stand of *Pinus Murrayana*. A small number of *Pinus monticola* has been found on Davis Creek and Slough Creek in southern Montana and *Abies grandis* has been reported from Yellowstone Park.

In the Big Horn Mountains the coniferous forest is represented by but four species: *Pinus Murrayana*, *P. flexilis*, *Picea Engelmannii* and *Pseudotsuga mucronata*, of which the first makes up perhaps ninety per cent. of all.

The forest in the Black Hills consists mostly of bull pine, *Pinus scopulorum.* On the northern exposure of Harney Peak and the northern end of the limestone district above an altitude of 4,500 feet, there is some spruce, but it is not *Picea Engelmannii* but a form of the white spruce, *Picea canadensis*, with unusually short cones. This attains a height of about 100 feet and a diameter of nearly three feet. *Betula papyrifera*, *B. fontinalis*, *Populus angustifolia* and *P. tremuloides* are present. In the Foothill Zone are added *Quercus macrocarpa*, *Negundo interius*, *Populus Sargentii*, *P. acuminata*, *Ulmus americana*, *Ostrya virginiana*, and *Sabina scopulorum.* From this can be seen that the Black Hills do not represent a typical part of the Northern Rockies, as their forest flora contains fully as many species belonging to the eastern United States.

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